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ABSTRACT

By using word problems relevant to agricultural occupations, this workbook presents a concept-oriented approach to competency development in seven areas of basic mathematics: (1) the expression of numbers as figures and words; (2) the addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals; (3) ratios and proportions; (4) percents; (5) problem solving; (6) geometry; and (7) graphs and charts. For each competency area, the workbook presents a series of word problems designed to reinforce student learning and to demonstrate the applicability of the mathematical concepts to the agricultural work environment. An answer key is appended. (JP)

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PERSONAL ACHIEVEMENT

MATHEMATICS

Agriculture

Prepared by

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Fund for the Improvement of Postsecondary Education

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Prepared By

Betty Baenziger
Mathematics
Curriculum Developer
1977

The problems found in this booklet are not meant to instruct you in the field of Agriculture. They are practices of the various mathematical concepts and are content oriented to help show the practicality of each concept.

Study each mathematical competency in the general learning packets before attempting these applied problems.

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CONTENTS

INTEREST AREA AGRICULTURE

NUMERATION

WHOLE NUMBERS
- ADDITION AND SUBTRACTION
- MULTIPLICATION
- DIVISION

FRACTIONS
- ADDITION AND SUBTRACTION
- MULTIPLICATION
- DIVISION

DECIMALS
- ADDITION AND SUBTRACTION
- MULTIPLICATION
- DIVISION

RATIO AND PROPORTION

PERCENT

PROBLEM SOLVING

GEOMETRY

GRAPHS AND CHARTS

Numeration

1. In 1970 there were one hundred forty thousand three hundred fifty four farms in Iowa with thirty three million five hundred sixty nine thousand six hundred twenty nine acres. Write the standard numerals for each number.

2. Cash receipts from marketing crops and livestock in 1972 totaled sixty four billion six hundred thirty one million eight hundred one thousand dollars. Write the standard numeral for the number.

3. The U. S. Department of Agriculture makes payments to each state for its agriculture. In 1972 three hundred four million nine hundred forty eight thousand dollars was spent in Iowa on feed grain programs. Write the standard numeral for this number.

4. More bushels of corn are produced each year than any other grain. In 1972, 5,473,727,000 bushels of corn were harvested. Write that number in words.

5. The population of cows in the United States was 121,990,000 in 1972. Write that number in words.

6. Iowa led the nation in corn production in 1973 with 1,204,200,000 bushels of corn. Write that number in words.

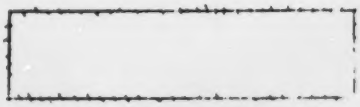
7. On September 1, 1973, the United States had a 60 million bushel supply of soybeans on hand. Write the standard numeral for this number.

8. The 1975 U. S. crop of soybeans was 425 million bushels. Write the standard numeral for this number.

9. In 1976, one million seven hundred eighty thousand five hundred acres of Iowa farmland was chisel-plowed and planted. Write the standard numeral for this number.

Addition & Subtraction

1. Mr. Jones needs to fence in a field measuring 20 rods wide and 80 rods long. How many rods of fencing will he need?



2. Old farmer Tucker wants to purchase a new tractor for $10,050.00. If he has saved $6,690.00, how many dollars must he borrow to make the purchase?

3. The net income per farm in Iowa for the year 1972 was $11,626. The same income for Arizona was $32,672. What was the difference in incomes?

4. The total Canadian production of oats in 1972 was 300,308,000 bushels. Their flax production for the same year was 19,017 bushels. How much more oats than flax was grown?

5. The United States produced a total of 1,544,775,000 bushels of wheat in 1972. If Canada's crop was 533,288,000 bushels, what was the total production of the two countries?

6. A farmer has planted 376 acres of corn, 68 acres of soybeans, and 36 acres of popcorn. He has 43 acres which he does not plant. How many acres does his farm contain?

7. A survey of planting methods shows that 1,780,000 acres were chisel plowed and planted, 272,000 acres were till planted, 194,000 acres were strip-tilled, 106,000 acres were slot planted, and 3,784,000 acres were planted with some other methods. How many acres were in production by all methods of planting?

8. During February of 1976, 9 million pounds of meat were put in cold storage. In February of 1977, only 6 million pounds were put in storage. How much more was in cold storage in that month in 1976?

Multiplication

1. Farmer Mahan had 47 carloads of corn. If each load contains 1,150 bushels, how many bushels of corn does he have?

2. The average water requirement of horses is 9 gallons per day. If you are raising 20 horses, about how much water would you need per week (7 days) for the horses?

3. About 10 pounds of nitrogen is required per acre for producing corn. If the Harring family farms 520 acres (340 acres of which are corn), what would be their yearly nitrogen need in pounds?

4. Last year 50,000 farms were planted using conservation tillage. The farms averaged 122 acres. How many acres were conservation tilled?

5. An auxiliary fuel tank can be mounted on the front of a tractor. One model of fuel tanks holds 35 gallons and weighs 125 pounds. If fuel weighs 8 pounds per gallon, how much will the fuel in each tank weigh?

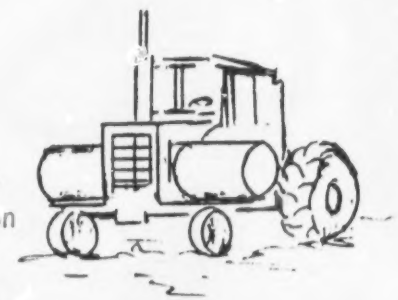
Division

1. A farmer can expect to yield 45 bushels of soybeans per acre. How many acres of soybeans should he plant in order to yield 2150 bushels?

2. A farmer spent 4 days planting 176 acres of corn. How many acres of corn did he plant each day?

3. A corral 90 feet by 54 feet will hold 50 cows. How many corrals this size will it take to hold 275 cows?

4. The United States plants about 72 million acres of corn per year. If the production from each acre was equal, how many bushels would each acre yield if the total production in 1973 was 5,643,300,000 bushels?



5. Corn is sometimes seeded in the row behind a small stream of water to speed germination. A 300 gallon tank is mounted on the planter and a 1,000 gallon refill tank is available. If 20 gallons of water is needed per acre, how many acres can be planted with the two full tanks?

Introduction To Fractions

1. Laverne owns a 120 acre farm and rents an additional 60 acres. What fractional part of his total acres does Laverne rent?

2. Susan has planted 124 acres of corn and 144 acres of soybeans. What part of the total acres is planted in soybeans?

3. A large orange grove in California sold locally 2 crates of oranges for every 7 crates produced. What fraction represents the part of their total production sold locally?

4. Last month Charles butchered a steer weighing 1050 lbs. and got 651 pounds of dressed beef. Write a fraction to represent the dressed beef compared to the total weight.

5. Using the fraction secured in problem 4, change this common fraction to a decimal fraction.

Fractions, + −

1. Chris planted $123\frac{1}{2}$ acres of wheat; $65\frac{1}{3}$ acres of corn; and $56\frac{1}{4}$ acres of oats. What was the total number of acres planted?

2. The average farm in Iowa is $239\frac{1}{10}$ acres. The national average is $390\frac{1}{2}$ acres. Iowa farms are how much smaller than the national average?

3. A Johnson County farmer planted $\frac{1}{4}$ section of land in corn, $\frac{1}{8}$ section in soybeans, $\frac{3}{16}$ section in oats, and the remaining was left as pasture. What section of land was pasture?

4. The Iowa Pork Producers Association spends $\frac{1}{3}$ of its budget for salaries, $\frac{1}{5}$ for administration, $\frac{1}{5}$ for communications, and $\frac{1}{10}$ for advertising. What fractional part of its budget was left for travel, education, and special projects?

5. A farm sale ad directed buyers to the farm in two different ways:

$\frac{1}{2}$ mile south, 6 miles west, and $\frac{2}{3}$ miles north from Tabor.

$2\frac{1}{2}$ miles east, 3 miles south, 2 east and $\frac{2}{3}$ mile north from Tyndall.

Buyers from which town had the shortest distance to travel?

Multiplying Fractions

1. One third of all Iowa farms are tilled using reduced tillage methods. Of these farms, $\frac{7}{8}$ are planted in corn. In fractions, how many Iowa farms are planted in corn using reduced tillage methods?

2. How many pounds of Aatrex 80W are needed for 232 acres of corn if the application rate was $2\frac{1}{2}$ pounds per acre?

3. Lucas planted $132\frac{1}{4}$ acres of wheat last year. He harvested an average of $13\frac{1}{2}$ bushels per acre. How many bushels did he harvest altogether?

4. Use of confetti bearing a farmer's number is used to identify grain. Five pounds of confetti will identify 40,000 bushels of grain.
   a) What fractional part of a pound of confetti is needed per bushel?
   b) How many pounds of confetti would then be needed to identify 16,800 bushels?

5. Part of the Barnes' garden is to be used for flowers. They wish to plant the following flowers spaced according to recommended standards. How many feet should they allow in order to plant two rows of each?

Flower	Row Spacing
Calendula	$\frac{2}{3}$ ft.
Forget-Me-Not	$\frac{3}{4}$ ft.
Phlox	$\frac{1}{2}$ ft.
Snapdragon	$\frac{5}{6}$ ft.

Dividing Fractions

1. If rows in one particular field are $2\frac{1}{2}$ feet apart, how many rows would that be in a field 880 feet wide?

2. How many rods are in a fence that is $\frac{1}{4}$ mile in length? (one rod is $16\frac{1}{2}$ feet; one mile is 5280 feet.)

3. A stack of lumber containing 2 x 10's is 24" high. How many 2 x 10's are in the stack?

4. Robin has just made $3\frac{1}{2}$ pounds of butter. She used $72\frac{1}{3}$ pounds of milk to make the butter. How many pounds of milk did it take for each pound of butter?

5. It takes $10\frac{1}{8}$ pounds of milk to make one pound of cheese. If you have 9 lbs. of milk how much cheese can you make?

Addition & Subtraction Decimals

1. A Johnson County farmer has planted corn in fields of 41.7 acres, 25.3 acres, 16.3 acres, and 4.2 acres. How many acres of corn does the farmer have planted?

2. The costs per acre of corn are $11.79 for harvesting, $2.20 for transporting to storage, $11.00 for drying, $5.50 for storage. What is the total cost per acre of corn for harvesting, shipping, drying and storage?

3. A corral for cattle cost $161.75. This was the cost for fence panels and posts? If the panels cost $143.12, how much did the posts cost?

4. The following amounts of rainfall fell in Iowa during a week in May:
Monday - 0.05 inches; Tuesday - 1.2 inches; Wednesday - 0.89 inches; Thursday - 2 inches; Friday - 0 inches; Saturday - 0.7 inches; and Sunday - 0.03 inches.
What was the total rainfall for the week?

5. Different types of meat put in cold storage in Feb. 1977 and the volume of each is listed below. How many total pounds of the three types were put in storage that month?

Beef	475.3 million pounds
Pork	196 million pounds
Lamb	13.8 million pounds

Multiplying Decimals

1. To be profitable, the price of soybeans should be 2.35 times greater than the price of corn. If corn sells at $2.25 per bushel, what should be the profitable price of soybeans per bushel?

2. The approximate weight of 1000 wild sunflower seeds is 6.57 gm. What would be the weight in pounds of 69,000 seeds? (453 gm per pound)

3. When harvesting hay with a Bale thrower approximately 1.16 man-hours/acre is used. What would be the man-hours to harvest 165 acres?

4. What is the sale value of 19.4 million bushels of soybeans shipped to Taiwan at a rate of $7.25 per bushel?

5. If a calf's weight can be calculated at 2.06 pounds per day of age, how much will it weigh after 200 days?

Dividing Decimals

1. A farmer has a flock of sheep which produced 1.7 lambs per ewe. If the farmer has 60 ewes, how many lambs did he have?

2. It takes 15 pounds of soybean seed to plant one acre. A farmer plans to plant 73.5 acres in soybeans. How many pounds of seed should he buy?

3. The cost for planting and harvesting an acre of soybeans was $167.55 in 1976. A farmer planted 62.5 acres of soybeans. What were his expenses for planting and harvesting?

4. The cost for hauling grain in $0.0225 per bushel. How much will it cost to haul 556 bushels?

5. It takes 0.6 gallons of diesel fuel per acre to operated a tractor to plant, fertilize, and apply herbicide. How many gallons of diesel fuel will it take to do 1175 acres?

6. The average annual precipitation in the northern part of Wisconsin is 31.2". How much is that per month? (Assuming equal amounts/month)

7. A case of canned sweet corn requires about 0.038 tons of fresh corn. If a case holds 24 jars, how many tons of fresh corn is that per jar?

8. One gallon of honey weighs approximately 11.78 pounds. How many gallons can be taken to the store in the trunk of a car with a capacity of about 306 pounds?

Ratio and Proportion

To each of the following write a proportion and solve.

1. The ratio of soybean prices to corn prices considered by economists as the breakeven point is 2:35. If corn is selling at $2.25 per bushel, what would the breakeven prices of soybeans need to be?

2. In the winter feeding of beef cows, one suggested ratio is 8 lbs. of mixed hay with 24 pounds of corn silage. If a total of 1,000 lbs. is to be mixed, how many lbs. of each is needed?

3. In raising alfalfa, the harvest removes P_2O_5 and K_2O from the soil. To insure top yields for all harvests, topdress annually with about 55 lbs. P_2O_5 and 180 lbs. K_2O for a 4.5 ton yield. How much K_2O should be used if a harvest of 75 tons is expected?

4. An eight year old registered Holstein cow from Story County, Iowa, set a 305 day milk production record of 32,080 lbs. At this same production rate, how many pounds would she produce in one year?

5. How many tons of feed can be bought for $91, if 8 tons cost $204?

Percent

1. The cost of growing one bushel of corn was 1.82 in 1975 and $2.04 in 1976. What was the percent increase in cost in 1976 compared to 1975?

2. A type of soybean seed should give an 8% increase in yield over the seed currently being used. If a farmer currently produces 45 bushels an acre, how many more bushels an acre should he produce using the new type of seed?

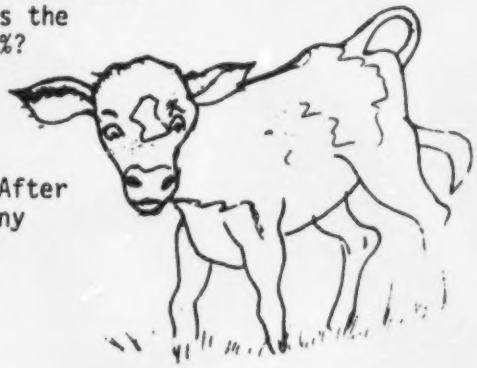
3. A mixture of fertilizer contains 25 pounds of nitrogen, 6 pounds of phosphorous, 9 pounds of potassium, and 2 pounds of sulphur. What percentage of the fertilizer is nitrogen?

4. A field planted with treated soybean seeds produces 79 bushels per acre. A field planted with untreated soybean seeds produces 57 bushels per acre. What percent increase in production does the treated seed get over the untreated seed?

5. Iowa has 128,500 farms containing 10 acres or more. 27% of these farms contain 300 to 400 acres. How many Iowa farms contain 300 to 400 acres?

6. 25% of all pigs born do not reach the age of 3 weeks. A farmer expects to have 250 pigs born. How many will die before the age of 3 weeks?

7. Robin took a calf to the butcher shop. The butcher said the calf's waste weighed 425 pounds. What was the calf's original weight if it dressed out at 62%?



8. Terry helped with the delivery of 90 calves. After two weeks $6\frac{1}{4}\%$ of the calves had died. How many calves still remained?

9. In July extra large apples were selling for $14.00 a bushel. At the peak of the crop in October, the price had dropped to $10.00 a bushel. What was the percent of decrease in the price of a bushel of apples?

10. The Kramers increased the number of trees in their orchard by 20%. Next year they plan to increase the total by another 20% so that they have 800 trees altogether. How many did they have when they started?

11. Flour costs $16.30 a barrel and was sold so as to gain $11\frac{1}{9}\%$. Find the increase in cost for each barrel.

12. The agriculture department bought a tractor for $44,000. After the first year the value decreased by 22%. What is the present value?

13. Mr. Caruthers sold a combine for $12,000 at a $12\frac{1}{2}\%$ loss. What had he originally paid for it?

14. A property owner sold a farm for $102,000 for a profit of 12.2%. What did he/she originally pay for the farm?

15. Albert Miller left his father's farm to open a store in town in which to sell their produce. Father Miller offered Albert a 10% commission on his sales. His books showed: potatoes $870, beans $750, carrots $340, corn $340, and butter $3,020. What will Father Miller receive from these sales?

16. A merchant sold 120 bushels of beans at $6.34 a bushel, 150 baskets of tomatoes at $3.00 a basket, and 120 bushels of peas at $1.75 a bushel. If the proceeds to the farmer are $1,065.00, what percent did the merchant keep?

Problem Solving

1. Five cents for every 30 dozen eggs goes for research and consumer education via the "National Egg Board". If 286 eggs are consumed per person per year, how much money is available to the Board assuming 200 million population.

2. A new herbicide combination recommends for soybeans $\frac{3}{4}$ lbs. of "Lehone" plus $1\frac{1}{2}$ pints "Treflen" per acre. Using this much mix, how much of each would be needed for 80 acres?

3. A new roller-type feed mill that minimizes profit - robbing dust waste, has the following capacities per hour:

   15 bushels oats
   35 bushels wheat
   50 bushels cracked corn

   How long would it take to process 5 bushels of oats, 7 bushels of wheat and 10 bushels of cracked corn?

4. Gaucho Carbon-Steel Barbed Wire comes in 80-rod spools (1/4 mile). If a rectangular field is to be enclosed with four strands of this wire and is $\frac{1}{4} \times \frac{1}{2}$ miles in size, how many spools should be purchased?

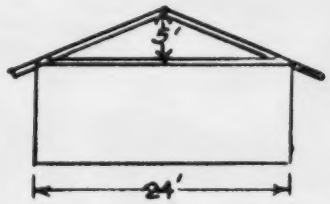
5. It takes 4 pounds of feed for each pound of weight for a salable lamb. If a feed ration is $140 per ton and feed is 80% of the total cost in raising the lamb, for what amount per pound should the lamb be sold to just break even?

Introduction To Geometry

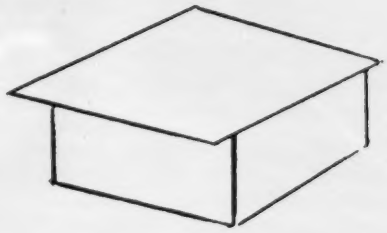
1. Ted Allen, Shelby County, Iowa, put a pet scraper in his hog house. Slats are 14" above the floor at the far end of the building and 26" above the floor at the end where the wastes are emptied by the scraper. What is the slope of the floor if the building is 152' long?

2. In the drawing at the right, the height of the ridge and the width of a building is given. If a 12" to 18" overhang for each rafter is desired, what length 2 x 8 rafters should be purchased?

   Use the Pythagorean Theorem $a^2 + b^2 = c^2$ to estimate the length.

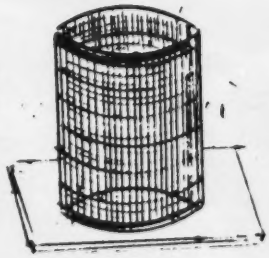


3. A storage shed has a shed roof that is 42' by 28'. If the cost for applying a cold cement built-up roof is approximately $5.85 per square, find the cost for the roofing of the shed.



4. A round steel farm water tank 7' in diameter and 2' deep holds approximately 560 gallons of water. Approximately how many gallons is this per cubic foot?

5. A round heavy-guage steel wire corn crib 12' 8" in diameter and 10' high to its eave holds approximately 679 bushels. From this, calculate the amount of corn in one cubic foot.



Graphs

	COSTS PER ACRE			
	CORN		SOYBEANS	
ITEM	1975	1976	1975	1976
Growing	17.63	18.68	14.87	16.10
Harvesting & Storage	27.24	30.49	9.77	12.21
Seeds & Chemicals	68.40	63.80	36.80	32.80
Overhead	5.20	7.91	3.45	4.28
Labor	13.62	15.08	10.12	11.16
Land Cost	67.50	88.00	67.50	88.00
TOTAL COST	199.59	223.96	142.31	167.55

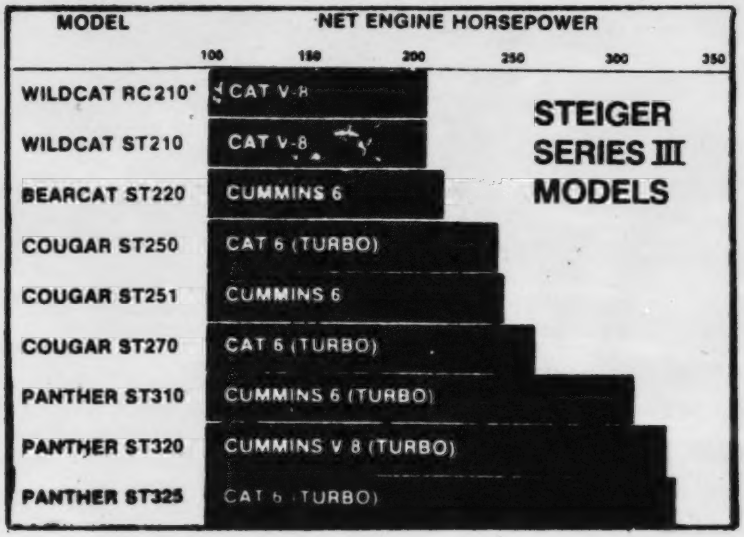
1. Using the chart above answer each of the following:

   (a) Which cost more for labor in 1976, corn or soybean production?

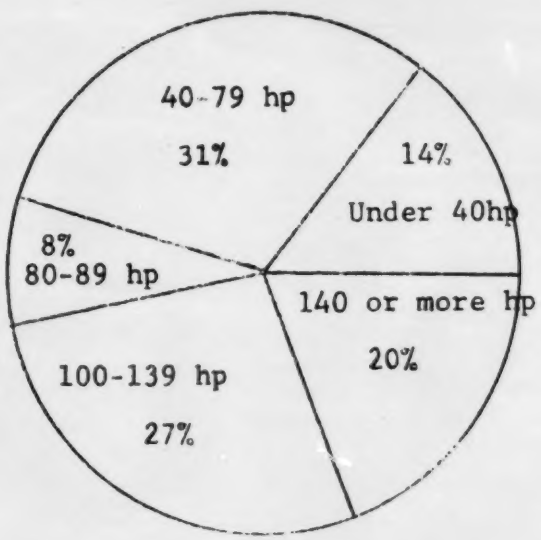
   (b) What was the cost of harvesting and storage for soybeans in 1975?

2. The bar graph below records the net engine horsepower for 9 4-wheel drive tractors. Approximate the net horsepower for each of the following:

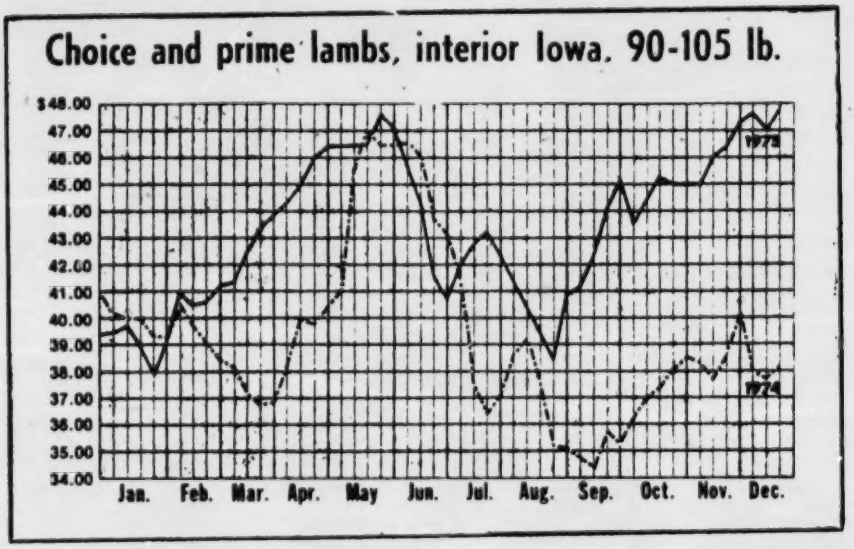
(a) Bearcat ST220
(b) Cougar ST270
(c) Panther ST310



3. The circle graph below shows the breakdown of the 1975 sales of 161 thousand tractors according to horsepower rating. Approximately how many tractors of each horsepower grouping were sold?



4. The graph below shows the farmer's sale price per hundred pounds of lamb. From the graph answer the following questions:
   a) When and what was the lowest price for lamb in 1974? 1975?
   b) Compare the highest price for lamb in the two years 1974 and 1975. What was the difference in this for the 2 years?
   c) Forecasters predicted the price of lamb in May of 1976 would be about $55. What percent increase would that represent of the maximum price of lamb in May of either 1974 or 1975?



5. Make a bar graph to show the following information concerning the amount of water needed per day by farm animals.

   Horses - 9 gallons/day
   Cows - 8½ gallons/day
   Hogs - 2½ gallons/day
   Sheep - 1½ gallons/day

ERROR - first 3 are multiplication

Dividing Decimals

1. 102 ewes
2. 1102.5 lbs.
3. $10,371.88
4. $12.51
5. 705 gals.
6. 2.6 in./mo.
7. 0.001583 tons
8. 25.98 ≐ 26 gals.

Ratio & Proportion

1. $\frac{2}{35} = \frac{x}{2.25}$ ANS. $.13
2. $\frac{8}{32} = \frac{x}{1000}$ ANS. 250 lbs. hay, 750 lbs. corn
3. $\frac{180}{4.5} = \frac{x}{75}$ ANS. 3000 lbs. K_2O
4. $\frac{305}{32080} = \frac{365}{x}$ ANS. 38,390.82 lbs.
5. $\frac{8}{204} = \frac{x}{91}$ ANS. 3.57 ton

Percent

1. 12.09%
2. 3.6 bu.
3. 59.52%
4. 38.6%
5. 34,695 farms
6. 63 pigs
7. 1118.42 lbs.
8. 84 calves
9. 28.57%
10. 556 trees
11. $1.81
12. $34,320
13. $13,714.29
14. $90909.09
15. $532
16. 25%

Problem Solving

1. $7.94 million
2. 60 lbs. Lehore
   120 lbs. Treflen
3. $\frac{1}{3}$ hr. oats, $\frac{1}{5}$ hr. wheat, $\frac{1}{5}$ hr. corn
4. 24 spools
5. $.35/lb.

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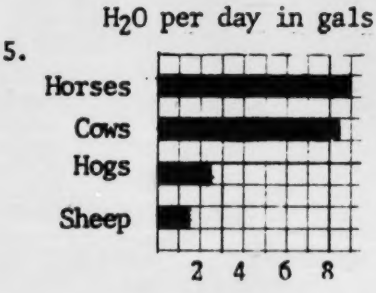
Introduction to Geometry

1. $\frac{1}{152}$ ft.
2. 14 - $14\frac{1}{2}$ ft.
3. $6879.60
4. 7.28 gals./cu. ft.
5. 0.54 bu./cu. ft.

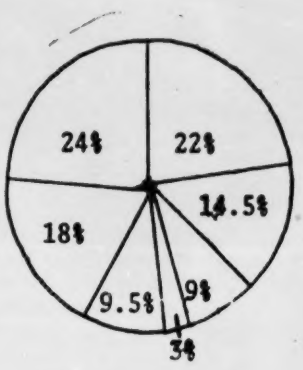
Graphs

1. a) corn
   b) 9.77/acre
2. a) 215 hp. b) 260 hp. c) 310 hp.
3. 4-79 hp. 50 thousand
   40 hp. 20 thousand
   80-89 hp. 13 thousand
   100-139 hp. 43 thousand
   140+ hp. 32 thousand
4. a) Sept. $34.50
   b) 47 - 1974
      48 - 1975 $1 difference
   c) 15.8% 17%

5.



6.



7.